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X-ray Microtomography Study of Metal Distribution in Sediments related to Pore Structure Modification by Mineral Dissolution and Neophase Formation under Extremely Alkaline Conditions

S. Yoon (BNL), K.W. Jones (BNL), A. Lanzirotti (U. of Chicago), H. Feng (Montclair State U.), W. Um (PNNL), R.J. Serne (PNNL), K.G. Karthikeyan (U. of Wisconsin), and W.F. Bleam (U. of Wisconsin)

Beamline(s): X26A, X27A

REDOX tank waste streams at the Hanford DOE sites are extremely alkaline and silicate minerals in surrounding sediments would dissolve and secondary solid phases would form as the alkaline solution with a high aluminum concentration infiltrates. These processes may modify the pore structure of the sediments, subsequently affecting the solute transport. In this study, simulated tank waste solutions comprising high levels of hydroxide, aluminum, sodium, and nitrate are flowed through miniature sediment columns with mineral phases commonly occurring in Hanford sediments under a saturated flow condition. The pore structure modifications are examined by x-ray absorption microtomography study and the distributions of metal contaminants in the columns are observed by x-ray fluorescence microtomography study at the National Synchrotron Light Source. We also determine whether these metal distributions are related with silicate neophase distributions using germanate ions as tracers for dissolved silicate ions by x-ray fluorescence study. We have obtained x-ray fluorescence microtomograms at X26A, for a sediment column with natural quartz and feldspar, which are known to have low impurities, but the interference by trace amount impurities still prevented us from concluding the study. The x-ray fluorescence study will be performed using pure synthetic mineral phases and long-term reaction samples are in preparation.

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